Robert E. Rudd

Lawrence Livermore National Laboratory
7000 East Avenue, L-045, Livermore, CA 94550 USA
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EXPERIENCE

Physicist, *Lawrence Livermore National Laboratory*, Livermore, CA 2000-now
Conducting theoretical and numerical research on mesoscopic elastic dynamics and multiscale simulation of the mechanics of materials. Research focuses on the mechanical behavior of sub-micron MEMS, nanoscale plasticity and fracture, and cell mechanics. **Deputy Group Leader**, 2002-now. **Academic Director**, CCMS Summer Institute, 2002-now.

Departmental Lecturer in Modelling of Materials, *Oxford University*, Oxford, UK 1998-2000
(Also Senior Research Fellow at Linacre College) Conducted theoretical and numerical research on mesoscopic elastic dynamics and multiscale simulation of the mechanics of materials. Gave lecture courses and tutorials on undergraduate materials science and computing. Served on the Governing Body of Linacre College and the Steering Committee of the Materials Modelling Laboratory.

Research Physicist (Consultant), *SFA, Inc*. at *Naval Research Lab*, Washington DC 1996-98
Conducted theoretical research on micromachines and superconductivity. Invented Coarse-Grained Molecular Dynamics, extending atomistic simulation through a coupling of length scales (with J.Q.Broughton). Developed multiscale materials simulations using parallel (MPI) codes on IBM SP2s. Developed the theory of Single Spin Superconductivity, the superconducting state of half-metallic antiferromagnets (with W.E.Pickett). Prepared critical reviews of theoretical nuclear physics proposals.

Post-Doctoral Fellow in Physics, *Rutgers University*, Piscataway, NJ 1992-95
Developed new analytic and exact hybrid numerical/analytic techniques for the strong (nuclear) interactions in the low-energy confined phase. Proposed the topological QCD string. Studied the behavior of ultra-strong gravitational shock waves using an exact string calculation. Computed anomalous equal-time correlations in 2D turbulence.

Research and Teaching Assistant, *Princeton University*, Princeton, NJ 1990-92
Conducted string theory research. Assisted in Quantum Mechanics and E&M courses.

Consultant, *Solid State Theory Group, Naval Research Lab*, Washington, DC 1987
Computed the band structure of metal oxides under extreme pressure using LAPW. The FORTRAN code was run on IBM and Cray supercomputers. (Summer job)

Summer Intern, *Surface Physics Group, Night Vision Lab*, Ft. Belvoir,VA 1982-83
Studied narrow band gap semiconductors using Auger and Hall effect methods. 1985-86
Co-discovered the aluminum oxide passivation technique for Mercad Telluride.

Consultant, *PRC* at *NASA Headquarters*, Washington, DC 1984
Assisted in graphics development and VAX systems programming. (Summer job)

EDUCATION

Ph.D. in Physics	Princeton University	Advisor: David J. Gross	1992
M.A. in Physics	Princeton University		1989
B.S. in Physics and Math	University of Virginia	(Highest Distinction, GPA 4.0)	. 1987

REFEREED PUBLICATIONS

1. T. V. Ratto, K. C. Langry, **R. E. Rudd**, R. L. Balhorn, M. J. Allen, M. W. McElfresh, "Spectroscopy of the Double-Tethered Concanavalin-A Mannose Bond," Biophys. J. **86**, ??? (2004).
2. **R.E. Rudd**, G.A.D. Briggs, A.P. Sutton, G. Medieros-Ribiero and R.S. Williams, "Equilibrium model of bimodal distributions of epitaxial island growth," Phys. Rev. Lett. **90**, 146101 (2003).
3. D.H. Kalantar, **R.E. Rudd**, et al, "High-pressure, high-strain-rate lattice response of shocked materials," Phys. of Plasmas **10**, 1569-76 (2003).
4. D. Steigmann, E. Baesu, **R.E. Rudd,** J. Belak, and M. McElfresh, "On the variational theory of cell-membrane equilibria," Interfaces and Free Boundaries **5**, 357-66 (2003).
5. E. Baesu, **R.E. Rudd**, J. Belak and M. McElfresh, "Continuum Modeling of Cell Membranes," Intl. J. Non-linear Mech. **39**, 369-77 (2003).
6. J.A. Moriarty, J.F. Belak, **R.E. Rudd**, P. Soderlind, F.H. Streitz and L.H. Yang, "Quantum-based atomistic simulation of materials properties in transition metals," J. Phys.: Condens. Matter **14**, 2825-57 (2002), and cover illustration.
7. M. McElfresh, E. Baesu, R. Balhorn, M.J. Allen, J. Belak and **R.E. Rudd**, "Combining Constitutive Materials Modeling with Atomic Force Microscopy to Understand the Mechanical Properties of Living Cells," Proc. Natl. Acad. Sci. **99**, 6493-7 (2002); also in *Nanoscience: Underlying Concepts and Phenomena* (National Academy Press, Washington, DC, 2002), pp. 43-47.
8. **R.E. Rudd**, "Coarse-Grained Molecular Dynamics: Dissipation due to Internal Modes," Mat. Res. Soc. Symp. Proc. **695**, T10.2.1-6 (2002), pp.499-504.
9. **R.E. Rudd** and J.F. Belak, "Void Nucleation and Associated Plasticity in Dynamic Fracture of Polycrystalline Copper: An atomistic simulation," Computational Materials Science **24**, 148-153 (2002).
10. **R.E. Rudd**, "Concurrent Multiscale Modeling of Embedded Nanomechanics," Mat. Res. Soc. Symp. Proc. **677**, AA1.6.1-12 (2001).
11. **R.E. Rudd**, "The Atomic Limit of Finite Element Modeling in MEMS: Coupling of Length Scales," J. on Analog Integ. Circuits and Signal Proc. **29**, 17-26 (2001).
12. **R.E. Rudd** and J.Q. Broughton, "Coupling of Length Scales in Solid State Systems," in *Computer Simulation of Materials at Atomic Level* , P. Deak, T. Frauenheim, M.R. Pederson, eds. (VCH Verlagsgesellschaft Mbh, Berlin, 2000).
13. S.C. Erwin, A.A. Baski, L.J. Whitman and **R.E. Rudd**, "Frenkel-Kontorova Model of Vacancy-Line Interactions on Ga/Si(112)," Phys. Rev. Lett. **83**, 1818 (1999).
14. **R.E. Rudd** and J.Q. Broughton, "Coupling of Length Scales in Solid State Systems," Phys. Stat. Sol. **217**, 251 (2000).
15. **R.E. Rudd** and J.Q. Broughton, "Atomistic Simulation of MEMS Resonators through the Coupling of Length Scales," J. Modeling and Simulation of Microsystems **1**, 29 (1999).
16. **R.E. Rudd** and J.Q. Broughton, "Coarse-grained molecular dynamics and the atomic limit of finite elements," Phys. Rev. B **58**, R5893 (1998).
17. **R.E. Rudd** and W.E. Pickett, "Single-spin superconductivity: Formulation and Ginzburg-Landau theory," Phys. Rev. B **57**, 557 (1998).
18. **R.E. Rudd** and W.E. Pickett, "The Josephson Effect in Single Spin Superconductors," J. Chem. and Phys. of Solids **59**, 2070 (1998).
19. **R.E. Rudd**, "Light-Cone Gauge Quantization of 2D Sigma Models," Nuclear Physics **B427**, 81 (1994).

20. **R.E. Rudd**, "Compactification Propagation," Nuclear Physics **B352**, 489 (1991).

OTHER PAPERS

1. T.V. Ratto, K.C. Langry, **R.E. Rudd**, R.L. Balhorn and M.W. McElfresh, "Mono and Multivalency in Tethered Protein-Carbohydrate Bonds," to appear in Proc. Amer. Chem. Society, 2004.
2. E. T. Seppala, J. Belak, and **R.E. Rudd**, "Molecular Dynamics Study of void growth and dislocations in dynamic fracture of FCC and BCC metals," submitted to Proc Plasticity 2003.
3. J. Belak, J.U. Cazamias, D. Haupt, J. Kinney, M. Kumar, R. Minich, **R.E. Rudd,** C. Schuh, A. Schwartz and E.T. Seppala, "The plastically deformed zone surrounding incipient voids in spallation fracture from 3D X-ray tomography, 2D microscopy and molecular dynamics simulation," submitted to Proc Plasticity 2003.
4. **R.E. Rudd**, "Coarse-Grained Molecular Dynamics for Design of Nanomechanical Systems," in Proc. Intl. Conf. Comput. Nanoscience (Nanotech/ICCN'03), San Francisco, CA, February 2003, M. Laudon and B. Romanowicz, eds. (Computational Pub, Boston, 2003), V.3, pp. 500-503.
5. **R.E. Rudd**, M. McElfresh, R. Balhorn, M.J. Allen and J. Belak, "Modeling AFM Induced Mechanical Deformation of Living Cells," in Proc. Intl. Conf. Comput. Nanoscience (Nanotech/ICCN'03), San Francisco, CA, February 2003, M. Laudon and B. Romanowicz, eds. (Computational Pub, Boston, 2003), V.1, pp.138-141.
6. E. T. Seppala, J. Belak, and **R.E. Rudd**, "A Molecular Dynamics Study of the Effect of Triaxiality on Void Growth in Dynamic Fracture," in *Advances in Computational Engineering and Sciences 2002,* (Proc. ICES'02, Reno, NV, August 2002), S. N. Atluri and F. W. Brust, eds., (Tech Science Press, Palmdale, CA, 2002), in press.
7. **R.E. Rudd**, M. McElfresh, E. Baesu, R. Balhorn, M.J. Allen and J. Belak, "Modeling of the Deformation of Living Cells Induced by Atomic Force Microscopy," in Proc. Intl. Conf. Comput. Nanoscience (ICCN'02), San Juan, Puerto Rico, April 2002, M. Laudon and B. Romanowicz, eds. (Computational Pub, Boston, 2002), pp. 73-6.
8. **R.E. Rudd**, "Coarse-Grained Molecular Dynamics and Multiscale Modeling of NEMS," in Proc. Intl. Conf. Comput. Nanoscience (ICCN'02), San Juan, Puerto Rico, April 2002, M. Laudon and B. Romanowicz, eds. (Computational Pub, Boston, 2002), pp. 173-6.
9. **R.E. Rudd**, G.A.D. Briggs, A.P. Sutton, G. Medieros-Ribiero and R.S. Williams, "Equilibrium distributions and the nanostructure diagram for epitaxial quantum dots," in preparation for Proc. Royal Society, (2002).
10. **R.E. Rudd**, "A Unified Atomistic and Finite Element Model of the Dynamics and Thermodynamics of Silicon Microsystems," in *Advances in Computational Engineering and Sciences 2000,* (Proc. ICES'2K, Los Angeles, CA, August 21-25, 2000), S. N. Atluri and F. W. Brust, eds., (Tech Science Press, Palmdale, CA, 2000), pp. 1932-7.
11. **R.E. Rudd**, "Coupling of Length Scales in MEMS Modeling: the atomic limit of finite elements," in Proc. DTIP2000, Paris, France, B Courtois, et al, eds. (SPIE, Bellingham WA, 2000), Vol. 4019, pp.16-25.
12. **R.E. Rudd**, "The Atomic Limit of Finite Elements in the Simulation of Micro-Resonators," in Proc. MSM 2000, San Diego, CA, M. Laudon and B. Romanowicz, eds (Computational Pub, Boston, 2000), pp. 465-8.
13. **R.E. Rudd** and J.Q. Broughton, "Coupling of Length Scales and Atomistic Simulation of a MEMS Device," in Proc. DTM '99, Paris, France, B Courtois, et al, eds. (SPIE, Bellingham WA, 1999), Vol. 3680, pp.104-13.
14. D. Hess, N. Bernstein, **R.E. Rudd** and F.F. Abraham, "Coupling of Length Scales in Cracks

and Micromachines," in Proc. DoD HPC Users Group Conf., Monterey CA, June 1999.
15. **R.E. Rudd** and J.Q. Broughton, "Coupling of Length Scales and Atomistic Simulation of a MEMS Device," in Proc. DoD HPC Users Group Conf., Houston TX, June 1998.
16. **R.E. Rudd** and J.Q. Broughton, "Coupling of Length Scales and Atomistic Simulation of a MEMS Device," in Proc. MSM '98, Santa Clara, CA, B Romanowicz, et al, eds (Computational Pub, Boston, 1998), pp. 287-91.
17. **R.E. Rudd**, "Light-Cone Gauge Quantization of Bosonic String Theories with Dilatons," Princeton Ph.D. Thesis, 1992.
18. M.J. Mehl, R.E. Cohen, H. Krakauer and **R.E. Rudd**, "LAPW Study of the High Pressure Behavior of Stoichiometric FeO," Proc. Mtg of Am. Geophys. Union, San Francisco, CA, 6-11 Dec 1987.
19. **R.E. Rudd**, "The Plasma Oxidation Mechanism in Mercury Cadmium Telluride," Night Vision Laboratory Internal Report, 1985

PREPRINTS FOR PUBLICATION

1. E. T. Seppala, J. Belak, and **R.E. Rudd**, "Effect of stress-triaxiality on void growth in dynamic fracture of metals: a molecular dynamics study," submitted to Phys Rev B, 2003.
2. C. Adelmann, B. Daudin, R. A. Oliver, G. A. D. Briggs and **R.E. Rudd**, "Nucleation of GaN/AlN quantum dots," submitted to Phys Rev B, 2003.
3. D. Mason, **R.E. Rudd** and A. P. Sutton, "Stochastic Kinetic Monte Carlo algorithms for long-range Hamiltonians," submitted to Computer Physics Communications, 2003.
4. D. Mason, **R.E. Rudd** and A. P. Sutton, "Atomistic modelling of diffusional phase transformations with elastic strain," submitted to J. Phys.: Condens. Matter, 2003.
5. M.J. Allen, J. Silveira, **R.E. Rudd**, R. Balhorn and M. McElfresh, "Direct Measurement of a Discrete Force-Pulse Driven by Axonemal Dynein Motors in Live Sperm," submitted to Biophysical Journal (2003).
6. **R.E. Rudd**, "Coarse-grained molecular dynamics for computer modeling of nanomechanical systems," submitted to Intl. J. on Multiscale Comput. Engin., 2003.
7. **R.E. Rudd**, "Concurrent Multiscale Simulation at Finite Temperature," submitted to Handbook of Materials Modeling, 2004.
8. E.M. Bringa, J.U. Cazamias, P. Erhart, J. Stolken, N. Tanushev, B.D. Wirth, **R.E. Rudd** and M.J. Caturla, "Atomistic shock Hugoniot simulation of single-crystal copper," submitted to J. Appl. Phys., 2004.
9. E.M. Bringa, M. Duchaineau, K. Rosolankova, **R.E. Rudd**, D.H. Kalantar, B.A. Remington, J.S. Wark and J. Belak, "Shock deformation of fcc metals on sub-nanosecond time scales," in preparation, 2004.
10. **R.E. Rudd** and J.Q. Broughton, "Coarse-grained molecular dynamics: Nonlinear finite elements and finite temperatures," in preparation for Phys. Rev. B (2004).
11. **R.E. Rudd** and J.F. Belak, "Characterization of plasticity in void growth through atomistic modeling," in preparation (2004).
12. **R.E. Rudd** and J.F. Belak, "Characterization of plasticity in molecular dynamics," in preparation (2004).

COMPUTER SKILLS

C, C++, Fortran, Java, MPI, Unix, Linux, Windows95, AVS, Mathematica, Maple, LaTeX, etc.

AWARDS AND AFFILIATIONS

LLNL Physical Data Research Program Award (with J. Moriarty, et al.)	2002
LLNL Physics Research Award (with J. Belak)	2001
American Chemical Society	2003-
Materials Research Society	2000-
Invited Participant, Isaac Newton Institute Program on Multiscale Microstructure	1999
US Association for Computational Mechanics	1999-
Masters of Arts by decree, University of Oxford	1998
Sigma Xi	1998-
American Physical Society (DCMP, DCOMP)	1992-
National Science Foundation Graduate Fellowship	1987-90
Joseph Henry Prize (Princeton University)	1987
Elkins Prize in Physics, McShane Prize in Math (University of Virginia)	1987
U.S. Government Incentive Award for Excellence in Research	1986
First Place, Putnam Math Exam, Mid-Atlantic Region	1986
Phi Beta Kappa	1985
Echols Scholar (University of Virginia)	1983-87
National Merit Scholarship	1983-84

GRANTS AND FUNDING

ASCI Dynamic Fracture project (co-PI with J. Belak) 2001-present.
LLNL LDRD Nanomechanics project (PI), $250k per annum, FY04-06.
LLNL LDRD Cell-AFM project (co-PI; M. McElfresh PI) $130k per annum, FY01-03.
LLNL UCRP grant (co-PI with M. Longo) $20k, 2002,2003.
ONR-IFO, EOARD, USARDSG, Psi-k, $18k for MML2000, 2000.
DARPA Grant, $25k, 1998-1999.
DOD High Performance Computing Grand Challenge Project (P.I. Jeremy Broughton)
200,000+ IBM SP2 hours per annum, 1997-2000

PROFESSIONAL SERVICE

Conference Organization:
Amer. Phys. Soc. DCOMP, March Meeting 2000, Minneapolis MN, March 2000.
Materials Modelling Laboratory Workshop, MML'99, Oxford England, Sept 1999.*
Materials Modelling Laboratory Workshop, MML2000, Oxford England, Sept 2000.*
Internatl. Conf. on Comput. Nanoscience (ICCN2001/MSM2001), Hilton Head SC, March 2001.
Modeling and Simulation of Microsystems, MSM'01, Hilton Head, April 2001.
Design, Test, Int. and Packaging of MEMS/MOEMS (DTIP2001), Cannes France, May 2001.
Atomically Controlled Surfaces, Interf. & Nanostruct. (ACSIN 2001), Lake Tahoe, July 2001.
LLNL Summer Institute, Livermore, CA, June-August 2001.*
Modeling and Simulation of Microsystems, MSM'02, San Juan, PR, April 2002.
Design, Test, Int. and Packaging of MEMS/MOEMS (DTIP2002), Cannes France, May 2002.
LLNL Summer Institute, Livermore, CA, June-August 2002.*
Modeling and Simulation of Microsystems, MSM'03, San Francisco, CA, Feb 2003.
Design, Test, Int. and Packaging of MEMS/MOEMS (DTIP2003), Cannes France, May 2003.
LLNL Summer Institute, Livermore, CA, June-August 2003.*
5th EUROMECH Solid Mechanics Conf., Thessaloniki, Greece, August 2003.
Modeling and Simulation of Microsystems, MSM'04, Boston, MA, March 2004.
Design, Test, Int. and Packaging of MEMS/MOEMS (DTIP2004), Montreaux, Switz. May 2004.
MRS Spring Meeting Nanomechanics Symposium, April 2004.
CECAM Workshop on Multiscale Modelling, Lyon, France, 2005.
*Principal organizer/Director.

Conference Session Chair:
Modeling and Simulation of Microsystems, MSM'03, San Francisco, CA, Feb 2003.
Amer. Phys. Soc., March Meeting 2000, Austin TX, March 2003.
Amer. Phys. Soc. DCOMP, March Meeting 2000, Minneapolis MN, March 2000.
Materials Modelling Laboratory Workshop, MML'99, Oxford England, Sept 1999.
Materials Modelling Laboratory Workshop, MML2000, Oxford England, Sept 2000.
European Materials Research Society Meeting (EMRS01), Strasbourg, June 2001.
Atomically Controlled Surfaces, Interf. & Nanostruct. (ACSIN 2001), Lake Tahoe, July 2001.

Referee:
Journal Editorial Board Member: Modelling and Simulation in Materials Science and Engineering
Journal Articles: Nature, Phys. Rev. Lett., Appl. Phys. Lett., Nanotechnology, Phil. Mag., etc.
Proposals: DARPA, DoE, NSF, ONR, NSERC

CONSULTANCIES

ENECO, Inc., Salt Lake City, USA 1998.

BOOK SERIES

Oxford Series on Materials Modelling, R.E. Rudd and A.P. Sutton, eds., Oxford University Press

INVITED TALKS

1. "Multiscale Simulation of Dynamic Fracture of Ductile Metals," Stanford Univ., Palo Alto, CA, February 4, 2004.
2. "Concurrent Multiscale Simulation of Solids," Multiscale Workshop, Livermore, CA, January 15, 2004.
3. "Atomistic and Multiscale Modeling of Void Growth in Ductile Metals," 2nd Intl. Workshop on Strength and Fracture, Berkeley, CA, January 7, 2004.
4. "Relevant Variables and Nanoscale Effective Models of Ductile Fracture," European Solid Mechanics Conference, Thessaloniki, Greece, August 19, 2003.
5. "Multiscale Modeling of Transition Metal Plasticity and Living Cell Mechanics," Biocomplexity V Conference, Notre Dame, IN, August 15, 2003.
6. "Plastic Deformation associated with Void Growth: Multiscale modeling," US National Congress on Computational Mechanics, Albuquerque, NM, July 29, 2003.
7. "Concurrent Multiscale Modeling," 2 Lectures at MRI Summer Institute, Livermore, CA, July, 2003.
8. "Nanomechanics through Concurrent Multiscale Simulation," American Chemical Society Meeting, New Orleans, LA, March 23, 2003.
9. "Atomistic Simulation of Void Growth Associated with Fracture at High Strain Rates," Materials Science Seminar, Univ. of Pennsylvania, March 20, 2003.
10. "Coarse-Grained Molecular Dynamics for Nano-Design," Keynote talk: Nanotech2003, San Francisco, CA, February 27, 2003.
11. "Modeling of the Mechanical Deformation of Living Cells in AFM," Chemical Engineering Seminar, UC-Davis, Davis, CA, November 4, 2002.
12. "Multiscale Modeling of Plasticity in Dynamic Fracture of Ductile Metals," Society of Engineering Science Conf., State College, PA, October 15, 2002.
13. "Multiscale Modeling of Plastic Deformation in Void Growth and Fracture," US National Congress on Theoretical and Applied Mechanics, Blacksburg, VA, June 27, 2002.
14. "Multiscale Modelling of Plasticity Associated with Void Growth in Dynamic Fracture," Intl. Conf. on Multiscale Materials Modelling, London UK, June 19, 2002.
15. "Modeling of the Deformation of Living Cells Induced during Indentation by an Atomic Force Microscope," Materials Seminar, Oxford University, June 11, 2002.
16. "Atomistic Simulation of Copper Fracture at High Strain Rates," Geophysical Laboratory Seminar, Carnegie Institution, Washington, DC, June 4, 2002.
17. "Coarse-Grained Molecular Dynamics and Multiscale Modeling of NEMS Resonators," Intl. Conf. on Computational Nanoscience (ICCN'02), San Juan, Puerto Rico, April 23, 2002.
18. "Multiple Time and Length Scale Techniques," Discussion Session co-leader, Intl. Conf. on Computational Nanoscience (ICCN'02), San Juan, Puerto Rico, April 23, 2002.
19. "Multiscale Modeling of Void Growth and Plasticity in Dynamic Fracture," Workshop on Multiscale Modeling, Bodega Bay, CA, October 7-10, 2001 (UCRL-PRES-145596).
20. "Multiscale Modelling of Void Formation in Dynamic Fracture," Materials Seminar, Oxford University, September 25, 2001.
21. "Multiscale Modelling of Dynamic Material Failure," CECAM Workshop: Modelling materials: from atoms to microstructures, Lyon France, September 19, 2001.
22. "Hybrid Atomistic and Continuum Modeling for Solids," 4 Lectures at MRI Summer Institute, Livermore, CA, July 24-27, 2001.
23. "Signatures of atomistic physics in sub-micron MEMS resonators," ACSIN'01, Lake Tahoe,

CA, July 11, 2001.
24. "Plasticity Associated With Dynamic Fracture: Atomistic and multiscale simulations," European Materials Research Society Meeting, Strasbourg, France, June 7, 2001.
25. "MEMS Modeling: Pushing the Limits of Miniaturization," Conference on High-Speed Computing, Salishan, OR, April 26, 2001.
26. "Bridging over Multiple Length and Time Scales," Round-Table Discussion, Materials Research Society Meeting, San Francisco, CA, April 20, 2001.
27. "Multiscale Modeling of Plasticity in Dynamic Fracture," Materials Research Society Meeting, San Francisco, CA, April 18, 2001.
28. "Concurrent Multiscale Modeling of Silicon Microsystems and Dynamic Fracture," Caltech, Pasadena, CA, April 5, 2001.
29. "Concurrent Multiscale Simulation and Coarse-Grained Molecular Dynamics," American Chemical Society Meeting, San Diego, CA, April 4, 2001.
30. "Design and Simulation of MEMS," (Invited tutorial) American Physical Society March Meeting, Seattle, WA, March 11, 2001.
31. "Grand Unification of Materials Models: Concurrent Multiscale Modeling," Materials Research Institute, Livermore, CA, Nov 1, 2000.
32. "Unified Atomistic and Finite Element Modeling of Silicon Microsystems and Dynamic Fracture," Computation and Mechanics Dept., Stanford University, Oct 26, 2000.
33. "Multiscale Modelling of Ge/Si Quantum Dot Growth and Ductile Fracture at Grain Boundaries," Intl. Workshop on Materials Modelling (MML2000), Oxford, UK, Sept 19, 2000.
34. "A Unified Atomistic and Finite Element Model of the Dynamics and Thermodynamics of Silicon Microsystems," Intl. Conf. on Computl. Eng. & Sci., Los Angeles, CA, Aug 23, 2000.
35. "Concurrent Multiscale Simulation: the link between dynamic atoms and continuum models," MML Seminar, Univ. of Oxford, May 12, 2000.
36. "Coupling of Length Scales in MEMS Modeling: the atomic limit of finite elements," keynote talk at the Symposium on Design, Test, Integration and Packaging of MEMS/MOEMS (DTIP2000), Paris France, May 11, 2000.
37. "Coarse-Grained Molecular Dynamics: Coupling length scales from the atomistic to the continuum," Applied Analysis Seminar, Maths Institute, Oxford, Jan 31, 2000.
38. "Concurrent Multiscale Simulation of Silicon Microsystems," LLNL, Nov 1, 1999.
39. "Coupling of Length Scales: Removing Atomic Degrees of Freedom via Finite Elements at the Periphery," Materials Modelling Workshop, MML'99, Oxford, Sept 4, 1999.
40. "Molecular Dynamics: Simulation of Sub-micron Systems at Finite Temperature," Materials Modelling Workshop, Materials Modelling Workshop, MML'99, Oxford, Sept 2, 1999.
41. "Multiscale Simulation of Dynamical Processes in Silicon Microsystems," 5th US National Conference on Computational Mechanics, USNCCM'99, Boulder CO, Aug 5, 1999.
42. "Multiscale Simulation of Sub-micron Structures on Semiconductor Surfaces," Naval Research Laboratory, July 13, 1999.
43. "Multiscale Simulation of Silicon Micro-structures," NIST Workshop on Multiscale Modeling, NIST, Gaithersburg MD, May 13, 1999.
44. "Coupling of Length Scales in the Physics of Microsystems," Imperial College London, UK, May 5, 1999.
45. "Micromachines," Linacre College, UK, March 2, 1999.
46. "Multiscale Phenomena in Silicon Microsystems," MML Seminar, Oxford, Feb 19, 1999.
47. "Multiscale Simulation of Dynamical Processes in Silicon," Maui International Meeting on

High-Temperature Materials, Maui HI, Jan 4, 1999.
48. "Multiscale Simulation and High Performance Computing," Louisiana State, Nov 2, 1998.
49. "Coupling of Length Scales in Semiconductors," Brown University, Sept 16, 1998.
50. "Coupling of Length Scales and Atomistic Simulation of MEMS Devices," Los Alamos National Laboratory, June 25, 1998.
51. "Coupling of Length Scales and Atomistic Simulation of MEMS Devices," DOD High Performance Computing Users Group Conf., Houston, Texas, June 3, 1998.
52. "Coupling of Length Scales and Atomistic Simulation of MEMS Devices," Technical University of Denmark, May 26, 1998.
53. "Coupling of Length Scales and Atomistic Simulation of MEMS Devices," Oxford, May 22, 1998.
54. "Coupling of Length Scales and Atomistic Simulation of MEMS," MIT, May 12, 1998.
55. "Coupling of Length Scales and Atomistic Simulation of MEMS," UC-Davis, April 9, 1998.
56. "Superstring Theory," Georgetown University, October 30, 1997.
57. "Superstring Theory," Naval Research Laboratory, January 1997.
58. "Two Dimensional QCD on the Torus," Rockefeller University, May 1993.
59. "Compactification Propagation and Light-Cone String Theory," Rockefeller Univ, Dec 1991.

STUDENTS AND OTHER SUPERVISEES

1. Daniel Mason, D. Phil 2003, 1999-2002, Oxford
2. Eira T. Seppala, Post-doc, 2001-Present, LLNL
3. Eveline Baesu, Visiting Professor, Summer 2001, LLNL
4. Matt Fago, Graduate Student, Summer 2002, LLNL

REFERENCES

(Letters will be provided upon request.)

Dr Jeremy Q. Broughton (J.P. Morgan, ex-NRL): jeremy.broughton@att.net
Professor Warren E. Pickett (UC-Davis), pickett@physics.ucdavis.edu
Professor Adrian P. Sutton (Oxford), adrian.sutton@materials.oxford.ox.ac.uk

Alternates: Professor David G. Pettifor (Oxford), david.pettifor@materials.oxford.ox.ac.uk
Professor David J. Gross (ITP-Santa Barbara), gross@itp.ucsb.edu
Professor David J. Nagel (George Washington Univ.), nagel@seas.gwu.edu